

US-PAT-NO: 5720026

DOCUMENT-IDENTIFIER: US 5720026 A

TITLE: Incremental backup system

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Brief Summary Text - BSTX (9):

Hitherto, in UNIX systems, etc., incremental backup wherein only the difference data updated since the most recent backup is backed up without backing up the entire data has been provided in a file system. However, the incremental backup in the file system is to check all files in the file system to be backed up for the update time and if the update time is newer than the last backup execution time, save the file. For example, if the file is a giant database file, the whole file must be backed up although the data update portion is slight for the whole file.

Brief Summary Text - BSTX (12):

Then, attention is given to the incremental backup system for backing up only updated or added data without backing up full data. However, the incremental backup system installed in the UNIX systems, etc., backs up the whole file depending on the last update time, thus always backs up the full file used by an application repeating reference/update to/of one file like a database; it is insufficient.

Brief Summary Text - BSTX (29):

The incremental backup system may further include difference restoration means for inputting the backup data stored in the backup unit and restoring the input block data to the storage unit based on the position of the block in the storage unit and the backup generation in which the block has been updated to the difference map information.

Detailed Description Text - DETX (23):

The pseudo device driver is defined as a device driver having no actual device in the UNIX system and does not manage any actual device; an interface like a normal device driver interface is defined between the difference management mechanism 203 and the UNIX operating system. The application program can use system calls such as open, close, read, write, and ioctl to indirectly call pseudo device driver subroutines. If the pseudo device driver is defined as a block device, it can also be used from a file system, etc., through a strategy interface.

Detailed Description Text - DETX (25):

When the incremental backup data is restored, namely, when the difference map information 600 and block data gotten as the incremental backup data are written into the pseudo device driver, the difference management mechanism 203 has a function of restoring the block data to the disk unit or the logical disk unit where the backup in the generation to reproduce the difference data is complete, based on the received difference map information 600.

Detailed Description Text - DETX (26):

The interface of the difference management mechanism 203 is used as the

pseudo device driver interface and the above-mentioned functions are provided, whereby a simple incremental backup and restore interface can be provided.

Detailed Description Text - DETX (48):

Next, incremental backup restoring will be discussed by taking as an example, recovery executed when a fault in which the system becomes inoperative occurs on the first Thursday since the full backup.

Detailed Description Text - DETX (49):

Recovery of change data on the fault occurring day, executed with log data will not be covered. The system of the embodiment of the invention is again installed on the machine after recovery, and a volume of the same size as the volume previously backed up is reserved on the disk unit 111 or 112. Full backup restoring of the control command 207 is executed for the volume, whereby the meta-data 400 for the incremental backup is restored in the volume management information and the full backup data is restored on the volume.

Detailed Description Text - DETX (50):

The system manager uses the restore function of the control command 207 to restore incremental backup tape in order. The difference management mechanism 203 uses the check sum data 804 to check the data received from the control command 207 for validity and if the data is valid, restores the data to the corresponding volume area according to the block position shown in FIG. 9. If tape data is found invalid in the check with the check sum data 804, the system manager is informed of the incremental backup generation number.

Detailed Description Text - DETX (51):

In the restoring, tape in incremental backup generation 1 prepared on Tuesday and tape in incremental backup generations 2 and 3 prepared on Thursday may be restored. If the tape in incremental backup generation 1 prepared on Tuesday contains an error, tape in incremental backup generations 1 and 2 prepared on Wednesday and the tape in incremental backup generations 2 and 3 prepared on Thursday may be restored. If the generation 2 part of the tape in incremental backup generations 2 and 3 contains an error, after the tape in incremental backup generations 1 and 2 is restored, the tape in incremental backup generations 2 and 3 may be restored with restoring the generation 2 part inhibited.

Detailed Description Text - DETX (54):

The user can use a sequential read/write command, such as a dd command in the UNIX system, via the pseudo device driver interface to save difference block management data and difference data on sequential access storage media like tape without considering the actually updated blocks. To restore incremental backup data, the incremental backup data saved via the pseudo device driver interface can be written into the pseudo device driver interface in sequence for the backup volume where data to the generations preceding the incremental backup is already restored.

Detailed Description Text - DETX (56):

If data is compressed and stored on the save volume at the incremental backup time and the compressed data is decompressed and restored at the incremental backup data restoring time, the data amount of the incremental backup data can be reduced and the effective use of the backup media can be made.

Detailed Description Text - DETX (60):

From an operating system, it appears that the five disk packs 902-906 each containing an SCSI controller at target level are connected to the SCSI adapter 113. The SCSI specifications allow a maximum of eight target controllers on a single bus, three of which (ID7, ID6, and ID5) are used by a map storage disk of a disk unit 900 with an incremental backup function having a front panel shown in FIG. 11, the tape drive, and the SCSI adapter 113, and cannot be used by the operating system. In FIG. 11, tape drive 901 and disk packs 902-906 are mounted. The tape drive 901 and disk packs 902-906 in FIG. 11 are the same as those in FIG. 10. Numeral 907 is a full backup switch, numeral 908 is a full restore switch, numeral 909 is an incremental backup switch, numeral 910 is an incremental backup confirmation switch, numeral 911 is a difference restore switch, numeral 912 is a difference restore confirmation switch, and numeral 913 is a ten-key pad.

Detailed Description Text - DETX (65):

To execute difference restoring, the system manager mounts incremental backup tape on the tape drive 901, uses the ten-key pad 913 to select the disk packs 902-906 to which the incremental backup data is to be restored and specify the latest generation and scope contained in the backup tape, and presses the difference restore confirmation switch 912.

Detailed Description Text - DETX (66):

As in the description given so far, according to the second embodiment of the invention, the SCSI adapter 113 for controlling the disk unit 900 for storing data to be backed up and the tape drive 901 for storing backup data is provided and the difference management mechanism 203 is provided in the SCSI adapter 113, whereby incremental backup and restoring can be performed without burdening the operating system or software under the operating system control.

Claims Text - CLTX (13):

6. An incremental backup system as claimed in claim 1, further comprising difference restoration means for inputting the backup data stored in said backup unit and restoring the input block data to said storage unit based on the position of the block in said storage unit recording and the backup generation in which the block has been updated in said difference map information.